Project Title:
Solar irradiance forecasting, data assimilation, and visualization

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Project Information:
Our proposed research has two objectives. Their successful completion will significantly advance our understanding of the "space weather" component of the Sun-Earth connection, including an improved set of measurement requirements for future LWS space missions, and will provide the conceptual basis for a new operational forecasting tool. The specific objectives are:
1) perform a scientific parametric study to determine if a phenomena of "thermospheric weather" exists and, if so, describe the range of its implications for the operations of space systems; and
2) develop and validate the elements of an operational solar irradiance forecasting tool applicable to space systems.
In looking at thermospheric weather, we will parametrically investigate the two effects. These are the heating of the thermosphere upper boundary during five time scales of solar variability (1-72 hours large flare periods, 3-14 days Earth-facing disk irradiances, 14-30 days solar farside events, 1-6 months active region evolution and decay, and 1/2-11 year solar cycle variability) and the secular cooling from increased carbon dioxide and methane (anthropogenic) radiators at the lower thermospheric boundary. The combination of increased heating at the top and increased cooling at the bottom should generate a stronger temperature gradient and affect turbulent and eddy diffusion in the lower thermosphere, hence, "thermospheric weather." We will not investigate the effect of dynamics in this study. A second result of this thermospheric parametric study will provide the conceptual basis for forecasting on five time scales. We will develop algorithms that quantify the variability in each time scale and these algorithms can be used for forecasting solar irradiances in space system operations. The programmatic relevance encompasses two NASA Strategic Enterprises (Space and Earth Science) related to LWS. The proposed work will develop techniques (not time scales) related to both Enterprises. Included in these these techniques are demonstration of a unique solar irradiance forecasting concept, demonstration of a data assimilation and visualization technique, investigation of global climate change ef

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Program Element: Independent Investigation: LWS

Citations:

Summary: This work developed the seminal tool for empirical solar irradiance specification and forecasting, useful for research and operations.

Citation: The SOLAR2000 empirical solar irradiance model and forecast tool

- **Investigation Type:** Theory and Model Development
- **Existing theories/models/datasets which the study is based:** Regression analysis between solar 10.7 cm radio flux proxy and solar Lyman-alpha index with solar irradiance measurements of multiple satellites.
- **Domains:** Sun
